METHODS AND MATERIALS FOR CAPTURING AND MONITORING FLAMMULATED OWLS

Richard T. Reynolds[1] and Brian D. Linkhart[2]

Abstract.— Techniques for locating, capturing, and monitoring activities and movements of Flammulated Owls were developed during four years of study. Adults responded to imitated territorial song throughout the nesting season. Nests were found by noting vocalizations and behaviors associated with courtship-feeding and food transfers between the sexes. After fledging, broods were difficult to follow, unless the young or adults were radio-tagged. Adults and young were captured with noose poles, hoop nets, and mist nets. Backpack harnesses and tail-mounted transmitters were used on adults and backpacks on fledglings. Transmitter life was 30–40 nights.

The Flammulated Owl (*Otus flammeolus* [Kaup]) is a little-known insectivorous species (Ross 1969) associated with montane forests of western North America (Bent 1938, Winter 1974). One of the smallest owls in this region, it is probably migratory in the northern part of its range (Balda et al. 1975).

The Flammulated Owl is often found in association with mature ponderosa pine (*Pinus ponderosa*) or Jeffrey pine (*P. jeffreyi*) forests mixed with fir (*Abies* spp.), Douglas fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), or incense cedar (*Libocedrus decurrens*) (Johnson and Russell 1962, Bull and Anderson 1978, Marcot and Hill 1980, Reynolds pers. obs.). However, the owl has been recorded in forests of second-growth pine (Winter 1974), pinyon pine (*P. monophylla*) (Huey 1932), and aspen (*Populus tremuloides*) (Webb 1982). Because few studies have involved intensive nest searches, the extent of breeding in any of these forest types or ages is unknown.

The association of this owl with mature pine, a forest type that is heavily managed throughout the western United States, its dependence on cavities for nests, and reports that this species was not found in cutover forests (Marshall 1957, Phillips et al. 1964, Franzreb and Ohmart 1978), suggests that this owl and its habitat affinities need further research. Because reliable techniques for locating, capturing, and monitoring Flammulated Owls were not available, research on this species has progressed slowly.

We studied a nesting population of Flammulated Owls in a 4 km^2 area of mature ponderosa pine forest in central Colorado from 1980 to 1983. As many as six nesting attempts and from 6 to 10 presumably nonbreeding territorial males were observed or monitored each year on the area. We report techniques found useful for locating nests, capturing birds, and monitoring their movements and patterns of habitat use.

Locating Owls

Breeding adults were located from early May to mid-September by imitating their territorial song (see Marshall 1939, Winter 1971, Marcot and Hill 1980). On calm nights, singing owls can be heard to 1 km distance. We found that males responded more commonly, but females will occasionally sing prior to egg laying and after fledging. Nesting males respond less and sing on their own (without artificial stimulation) less than nonnesting males.

Prior to egg laying, both males and females were found in the vicinity of their nests by listening for the food solicitation (begging) calls of females (raspy "meow"s) and location calls of males ("boop-boop, boop-boop") when they entered the area with food. Fledged young were located by listening for their food begging (throaty hiss) and the location calls of adults. For the first five nights after fledging, broods remained within 100 m (but usually beyond 50 m) of their nests.

[1]Rocky Mountain Forest and Range Experiment Station, 240 West Prospect, Fort Collins, Colorado 80526.
[2]Department of Fishery and Wildlife Biology, Colorado State University, Fort Collins, Colorado 80523.

Thereafter, some broods moved to 1 km from the nests through a series of sporadic movements, each followed by several sedentary nights. We used six-volt flashlights to aid in observations of the owls.

Locating Nests

To identify nests, we first located and marked all trees containing cavity entrances greater than 4 cm diameter. When possible, we used a cavity-peeper (DeWeese et al. 1975) to confirm the suitability of cavities for owls. All Flammulated Owl nest cavities on our study area were flat bottomed and 18–40 cm deep, with minimum entrance diameters of 4–10 cm.

Each potential cavity was observed for 10–15 minutes at night to determine occupancy. The first three hours after dusk were the best because feedings were most frequent then (up to 7 feedings/15 minutes). When males approached with food they gave location calls, and females often responded by begging from within the cavity. About midway through nesting, both males and females fed the young in the cavity after calling quietly during approach. These calls were audible to 100 m under good conditions. The best procedure for checking suspected cavities was to take a position so as to highlight cavity entrances against the sky in order that approaching birds could be seen.

Capture and Handling

Four techniques were used to capture adults. During pair bonding and courtship feeding, when females are relatively sedentary, we used a 6.4 m telescoping noose pole with a 12.5 cm diameter loop of coated stainless steel line attached (Zwickel and Bendell 1967) to snare her or the male from trees. After egg laying and before fledging, both sexes were captured by placing a small mist net over the cavity entrance. The mist netting was formed to a bag (30 cm deep) and was woven to a wire hoop (40 cm dia) attached to the end of a telescoping pole. After the young fledged, adults were captured by tethering one or more young to the ground adjacent to a 3 × 6 m mist net. The mist net, shaped to form an L by wrapping it around a midpole, was placed so that the tethered young were inside and about 1.5 m from the corner. The high frequency of feeding in the early evening affords many opportunities to capture the adults. Owlets were captured by removing them from nests or by snaring them with noose poles after they fledged. In some cases we enlarged cavity entrances with rasps and files to gain access. Mist nets were used to capture adults from day roosts that were less than 4 m high. Nets were placed downslope from the roosts and the birds were flushed into them by approaching from the upslope side.

Handling of Flammulated Owls presents few problems. Immediately after capture the birds may struggle, but within a short time they become docile and may fall into a sleep that requires a minute or two from which to awake once released. When birds were held for extended periods (e.g., attaching transmitters), we inserted the owl into a sock with the toe end cut out but tied shut. This protected the bird and permitted us to lay it aside when necessary. When finished, the tied end was loosened and the bird slipped through.

Monitoring Nesting Activities

Because Flammulated Owls are quite tame, observations at the nest seemed to disturb them little. To determine diets and frequency of food delivery, we used a soft background light (gasoline lanterns) placed approximately 10 m from the nest. This permitted the use of binoculars to observe adults as they approached the nest. Because food items are transported in the bill, tripod-mounted cameras adjacent to the hole and pointed into the approach route were used to photograph food. Photos provided an excellent means of identifying Lepidoptera larvae and other arthropods.

Activities and Movements

Radio telemetry was useful in obtaining information on behavior, home range size, habitat use, intra- and interspecific interactions, and population densities.

Transmitter weights should not exceed 3–5% of a bird's body weight (MacDonald

and Amlaner 1980). Mean weights of males and females in our study were 53 and 58 g, respectively. Our transmitters weighed 2.3 g, measured 20 × 9 × 9 mm, and had a life of 30–40 days. Short transmitter life required that the birds be recaptured frequently. Transmission distances ranged from 100 to 800 m, the latter being under line-of-sight conditions. Preliminary results indicate males may move up to 800 m from nests.

Backpacks and tail-mounts were used to attach transmitters. Tail-mounted transmitters (Kenward 1978) were used on adults nesting in small cavities. The tail-mount is attached to the dorsal rachis of the central tail feathers with commercial hot-melt glue (Bruggers et al. 1981). To avoid getting glue on the uropygial gland, we kept the transmitters away from the body and used a minimal amount of glue (0.3 g is sufficient). A package that is too heavy (3.0+g) might result in feather breakage or premature shedding. Tail-mounts were not used on fledglings until tail feathers were fully developed.

The backpack harness (Smith and Gilbert 1981) was used for fledglings and adults. We used the double-loop style with dimensions of 12.5 cm (circumference) for the neck strap, 3.5 cm (length) for the breast strap, and 15 cm (circumference) for the body strap and the criss-cross style (overall length of 21.0 cm). Polyester elastic braid (3.1 mm wide) was used for strap material. The transmitter was attached to the harness with hot-melt glue before fitting the harness on the owl.

We used a portable receiver and a hand-held yagi antenna to follow individuals. Headphones facilitated direction-finding during pursuit and bad weather. Because males foraged over 17–27 ha and made frequent trips to their nests, it was helpful to have a co-worker at the nest to communicate with a two-way radio the owls' time of arrival and direction of departure. Although following the owls with hand-held antennae required considerable effort, this method (as opposed to triangulation) allowed direct observations that enabled us to determine foraging behavior and habitat use.

Acknowledgments

We thank E. Forsman, P. Hegdal, J. Jeanson, R. Ryder, and A. Wolfe for their help and suggestions during this study. We are obliged to E. Bull, E. Forsman, and R. Ryder for suggestions on the manuscript.

Literature Cited

Balda, R. P., B. C. McKnight, and C. D. Johnson. 1975. Flammulated Owl migration in the southwestern United States. Wilson Bull. 87:520–533.

Bent, A. C. 1938. Life histories of North American birds of prey. Part 2. U.S. Nat. Mus. Bull. 170. 466 pp.

Bruggers, R., J. Ellis, J. Sedgwick, and J. Bourassa. 1981. A radio transmitter for monitoring the movements of small passerine birds. Proc. Third Internat. Conf. Wildl. Biotelem. 3:69–79.

Bull, E. L., and R. G. Anderson. 1978. Notes on Flammulated Owls in northeastern Oregon. Murrelet 59:26–27.

DeWeese, L. R., R. E. Pillmore, and M. L. Richmond. 1975. A device for inspecting nest cavities. Bird Banding 46:162–165.

Franzreb, K. E., and R. D. Ohmart. 1978. The effects of timber harvesting on breeding birds in a mixed coniferous forest. Condor 80:431–441.

Huey, L. M. 1932. Two noteworthy records for California. Auk 49:107.

Kenward, R. E. 1978. Radio transmitters tail-mounted on hawks. Ornis Scand. 9:220–223.

Johnson, N. K., and W. C. Russell. 1962. Distributional data on certain owls in the western Great Basin. Condor 64:513–514.

MacDonald, D. W., and C. J. Amlaner, Jr. 1980. A practical guide to radio tracking. Pages 143–159 *in* C. J. Amlaner, Jr., and D. W. MacDonald, eds., A handbook on biotelemetry and radio tracking. Pergamon Press, Oxford.

Marcot, B. G., and R. Hill. 1980. Flammulated Owls in northwestern California. West. Birds 11:141–149.

Marshall, J. T., Jr. 1939. Territorial behavior of the Flammulated Screech Owl. Condor 41:71–78.

———. 1957. Birds of pine-oak woodland in southern Arizona and adjacent Mexico. Pac. Coast Avifauna 32:1–125.

Phillips, A., J. T. Marshall, and G. Monson. 1964. The birds of Arizona. Univ. Ariz. Press, Tucson.

Ross, A. 1969. Ecological aspects of the food habits of insectivorous Screech Owls. Proc. West. Found. of Vert. Zool. 1:301–344.

Smith, D. G., and R. Gilbert. 1981. Backpack radio transmitter attachment success in Screech Owls (*Otus asio*). N. Amer. Bird Bander 6:142–143.

Webb, B. 1982. Distribution and nesting requirements of montane forest owls in Colorado. Part III: Flammulated Owl (*Otus flammeolus*). Colorado Field Ornithol. J. 16:76–81.

Winter, J. 1971. Some critical notes on finding and seeing the Flammulated Owl. Birding 3:205–209.

———. 1974. The distribution of the Flammulated Owl in California. West. Birds 5:25–44.

Zwickel, F., and J. F. Bendell. 1967. A snare for capturing Blue Grouse. J. Wildl. Manage. 31:202–204.